

**Claims**

1. Dimensional weighing apparatus for use with object weighing apparatus and object pricing apparatus, the dimensional weighing apparatus including:

5       sensing apparatus for determining size data for an object to be weighed; and

10      control apparatus which receives size data from the sensing apparatus and which includes an interface for communicating with the weighing apparatus and an interface for communicating with the pricing apparatus;

15      the control apparatus in use being connected between the weighing and pricing apparatus, and outputting weight information to the pricing apparatus dependent on weight data from the weighing apparatus and size data from the sensing apparatus.

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2. The apparatus of claim 1, wherein the control apparatus determines a dimensional weight for the object based on the size data, and outputs the larger of the dimensional weight and an actual weight of the object as determined from the weight data.

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3. The apparatus of claim 1 or 2, wherein the control apparatus outputs the weight information as ASCII code in a continuous manner.

25      4. The apparatus of any preceding claim, wherein the sensing apparatus is adapted to determine the size of the object whilst the object is on the weighing apparatus.

30      5. The apparatus of any preceding claim, wherein the sensing apparatus is self-supporting.

6. The apparatus of any preceding claim, wherein the sensing apparatus includes non-contact type sensors.

7. The apparatus of any preceding claim, wherein the sensing apparatus includes sensors that sense a distance to the object.

8. The apparatus of any preceding claim, wherein the sensing apparatus includes ultrasonic, microwave and/or laser sensors.

9. The apparatus of any preceding claim, wherein the sensing apparatus includes one or more vertically-oriented sensors arranged in use over the object.

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10. The apparatus of any preceding claim, wherein the sensing apparatus includes one or more horizontally-oriented sensors.

11. The apparatus of any preceding claim, wherein the sensing apparatus and object rotate in use relative to one another.

12. The apparatus of any preceding claim, including a turntable on which the object is placed for size determination.

20 13. The apparatus of claim 12, wherein the turntable is adapted to be mounted in use on the weighing apparatus.

25 14. The apparatus of claim 12 or 13, wherein the turntable is connected to the control apparatus, and is activated by a signal from the control apparatus.

15. The apparatus of claim 12, 13 or 14, wherein the turntable rotates continually during sensing.

30 16. The apparatus of claim 15, wherein the turntable includes a rotation sensor for outputting a signal indicative of turntable position.

17. The apparatus of claim 16, wherein the rotation sensor outputs a signal once per revolution, and the turntable is configured to rotate at a constant speed.

5 18. The apparatus of any of claims 12 to 17, wherein the control apparatus correlates the size data with the rotational position of the turntable in order to determine a cross-sectional profile for the object.

10 19. The apparatus of any preceding claim, wherein the sensing apparatus provides data on at least one cross-sectional profile of the object and at least one height measurement of the object.

20. The apparatus of any preceding claim, wherein the sensing apparatus determines size data for a 360-degree profile of the object.

15 21. The apparatus of claim 19 or 20, wherein the control apparatus identifies the shape of the object through the peaks and/or troughs in the cross-sectional profile.

20 22. The apparatus of claim 21, wherein the control apparatus determines dimensions of the object cross-section based on the identified shape of the object, and on the dimension data for the object determined at the peaks and/or troughs of the profile.

25 23. The apparatus of any preceding claim, wherein the control apparatus determines cross-sectional profile data for the object and fits a minimum-area polygon to the profile data.

30 24. The apparatus of any preceding claim, wherein the control apparatus determines a cross-sectional profile of the object using one or more equally spaced apart horizontally-oriented sensors and a rotation of the object by an angle of 360 degrees divided by the number of horizontal sensors.

25. The apparatus of any preceding claim, wherein the sensing apparatus including a plurality of horizontally-oriented sensors arranged in use to lie at a number of different heights.

5 26. The apparatus of any preceding claim, wherein the sensing apparatus includes a plurality of vertically-oriented sensors arranged to in use lie above the object.

10 27. The apparatus of claim 26, wherein the vertically mounted sensors are mounted in an array that in use rotates about a vertical axis above the object.

15 28. The apparatus of any preceding claim, wherein the sensing apparatus includes one or more reflector elements for directing a sensing beam from a sensor onto an object to be measured.

20 29. The apparatus of claim 28, wherein the reflector element or elements are provided in use above an object to be measured, and reflect a sensing beam downwardly onto the object.

25 30. Computer software for determining a dimensional weight of an object, the software including a component for receiving actual weight data of an object, a component for receiving size data for the object, a component for determining a dimensional weight for the object based on the size data, and a component for outputting weight data for the object based on the actual weight data and the dimensional weight.

30 31. The software of claim 30, including a component for determining a volume for the object from a determined cross-sectional area of the object and a height measurement of the object.

32. The software of claim 31, wherein the cross-sectional area is determined as the area of a minimum-area polygon that will enclose a measured cross-sectional profile of the object.

33. A method of determining the dimensional weight of an object, the method including the steps of using one or more sensors to obtain size data of an object, using the size data to determine a dimensional weight of the object, intercepting actual weight data of the object from a set of scales, and outputting  
5 weight data to a pricing apparatus based on the actual and dimensional weights.
34. A method of determining the dimensional weight of an object, the method including the steps of providing a turntable on weighing apparatus, and  
10 using one or more sensors to obtain size data of the object as it is rotated on the weighing apparatus during the weighing process, obtaining the size data and the output of the weighing apparatus in order to determine a dimensional weight and an actual weight of the object, and outputting weight data to a pricing apparatus based on the actual and dimensional weights.  
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35. Weight determining apparatus including sensing means for determining a dimension of an object to be weighed, and a control means which in use connects between a weighing apparatus for weighing the object and a pricing apparatus for pricing the object based on the weight, the control unit  
20 determining a weight value for the object based on the output of the weighing apparatus and the output of the sensing means, and outputting the weight value to the pricing apparatus.
36. A parcel cubing and weighting unit for use with a set of scales and  
25 a pricing terminal, the unit including an interface for communicating with the pricing terminal, an interface for communicating with the set of scales, one or more sensors for obtaining size data of a parcel, and a control for reading an actual parcel weight from the scales interface, for determining a size-equivalent weight based on the size data, and for outputting one of the two weights  
30 through the pricing terminal interface.

37. Dimensional weighing apparatus configured in use to intercept weight data that is output from scales for measuring the actual weight of an object and is meant for receipt by a pricing terminal, and to output to the pricing

terminal either the actual weight data or dimensional weight data determined by the apparatus for the object.

38. Dimensional weighing apparatus including sensor means for  
5 obtaining a profile of distances between a reference point and the surface of an object in a cross-sectional plane of the object in a number of angular directions, and means for analysing the profile in order to determine dimensions of the object in that cross-sectional plane.
- 10 39. The apparatus of claim 38, wherein the apparatus determines a cross-sectional area for the object based on the analysis of the profile.
- 15 40. The apparatus of claim 39, wherein the cross-sectional area is determined as the area of a minimum-area polygon that will contain the detected profile.
- 20 41. Dimensional weighing apparatus including weighing apparatus for weighing an object, sensor apparatus for providing information on the size of the object, and a controller for determining a dimensional weight of the object based on the size information and for determining the actual weight of the object from an output of the weighing apparatus.
- 25 42. The apparatus of claim 41, wherein the object and sensor apparatus are rotated relative to one another in order to obtain the size information.
43. The apparatus of claim 41 or 42, wherein the sensor apparatus includes one or more cameras that take images of the object.
- 30 44. The apparatus of claim 41, 42 or 43, wherein the controller determines a cross-sectional profile of the object.
45. The apparatus of claim 44, wherein the controller determines a minimum area polygon into which the cross-sectional profile fits.

46. Dimensional weighing apparatus including means for weighing an object, one or more sensors for providing information on the size of the object, means for rotating the object and the sensors relative to one another, and a controller for determining a dimensional weight of the object based on the sensor information and for determining the actual weight of the object from an output of the weighing means.
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47. Dimensional weighing apparatus including apparatus for weighing an object, a turntable for rotating the object, one or more sensors for providing information on the size of the object as the object is rotated on the turntable, and a controller for determining a dimensional weight of the object based on the sensor information and for determining the actual weight of the object from an output of the weighing apparatus.
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48. Dimensional weighing apparatus including apparatus for weighing an object, one or more sensors for providing information on the size of the object, apparatus for rotating the sensor or sensors so as to provide information on a 360 degree profile of the object, and a controller for determining a dimensional weight of the object based on the sensor information and for determining the actual weight of the object from an output of the weighing apparatus.
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49. A docketing system including dimensional weighing apparatus according to any preceding apparatus claim, and means for producing a docket for an object based on the object's dimensional weight.
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50. A franking system including dimensional weighing apparatus according to any preceding apparatus claim, and means for franking an object based on the object's dimensional weight.
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51. A system for labelling an object including dimensional weighing apparatus according to any preceding apparatus claim, and means for printing a label for an object based on the object's dimensional weight.

52. A system for monitoring parcels including dimensional weighing apparatus provided at a plurality of customer and parcel delivery service locations, means for placing a label on a parcel at a customer's location based  
5 on information from the customer's dimensional weighing apparatus, and means for reading the label at the parcel delivery service locations.